Analysis of Relationships between Thermal Pressure and Volume Expansion for Solids at High Temperatures

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The volume expansion V/V_0, where V is the volume at temperature T and V_0 is the volume at initial temperature for solids at pressure P=0 is required for developing useful thermodynamic models in the field of high-temperature and high-pressure physics of solids (Anderson 1995). By using the basic data on V/V_0 versus T at P=0, it has been possible to generate computational methods to predict the values of (1) thermal expansivity α versus T along isochores; (2) thermal expansivity α versus temperature T at pressure P=0; (3) thermal expansivity α versus pressure P along isotherms; and (4) volume expansion versus temperature along isobars (Singh and Chauhan 2002, Anderson and Masuda 1994, Anderson *et.al*. 1995a, 1995b). The origin of these studies goes back to the Suzuki equation formulated by Suzuki et al (1979), which has been derived from Mie-Gruneisen equation of state (EOS). In the present study, we examine relationships between thermal pressure and volume expansion with temperature reported in the literature for NaCl, KCl, MgO, and CaO. Volume expansions are calculated for the solids under study at higher temperatures, up to their melting temperatures. Values of thermal pressure are taken from Anderson (1995). At higher temperatures, the values of thermal pressure have been estimated by assuming linear variation of thermal pressure with temperature (Anderson 1995). The results are compared with experimental data obtained from density measurements reported by Anderson (1995). It has been found that these results are in good agreement with experimental values of volume expansion for the solids under study up to very high temperatures, close to their melting temperatures.

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